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Control of Line Expansion in Drip Irrigation Systems

Steve A. Denison and Harold E. Messner[1]

Water can be used more efficiently by modifying a trickle drip irrigation system. Modifications include the use of a spring to control line movement caused by expansion and contraction.

Keywords: Drip irrigation, revegetation

A drip system is an ideal way to irrigate woody transplants on coal mine spoils in semi-arid climates, where evapotranspiration losses are high. However, the polyethylene pipe used in the system has a major disadvantage because it expands and contracts with temperature changes. This causes movement which repeatedly displaces emitters away from plant bases. If plants are not watered, water is wasted and plants may not survive. Line movement however can be minimized by placing the plastic pipe under moderate tension using a spring system.

The polyethylene tubing commonly used is sensitive to temperature changes, expanding as much as 1/8 inch per 100 feet of line for each degree F temperature increase.[2] Therefore, control of line movement is essential to keep drip emitters properly positioned when long lines are subjected to temperature fluctuations.

Installation

The trickle system in use is constructed of Poly-vinyl chloride (PVC) pipe for main supply lines, with polyethylene plastic lateral and feeder lines. The PVC main supply lines are placed above the ground, perpendicular to the plant rows, with feeder lines attached with tees at irrigated rows (fig. 1). To prevent damage to plant stems within the row, feeder lines are placed 1 foot from the plant bases. At each plant location, an emitter with a distribution tube running to the plant base is attached to the feeder lines.

Although there is no way to prevent expansion and contraction of a long plastic line lying on the ground, the movement can be restricted by placing the line under moderate tension. This minimizes movement during expansion, and aids repositioning during contraction.

To prevent the PVC main supply line from moving, two wooden or steel stakes can be driven into the ground on the discharge side of the supply line tee (fig. 1).

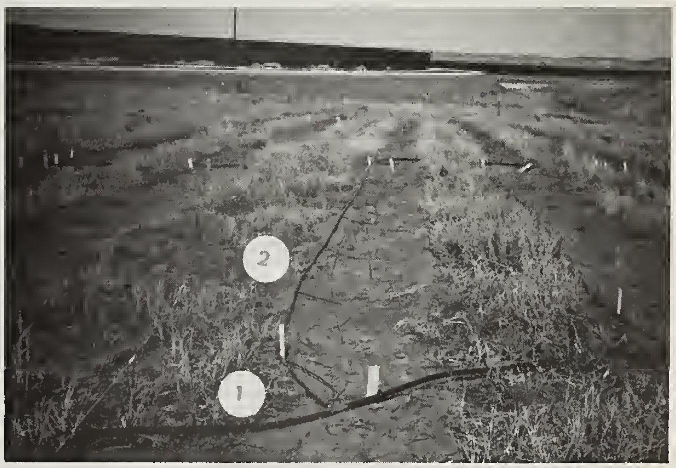

Figure 1.—Stake placement to prevent main feed line movement (1) lateral line, (2) feeder line.

[1] *Forestry Technician and Supervisory Range Technician with the Rocky Mountain Forest and Range Experiment Station, Rapid City, South Dakota in cooperation with the South Dakota School of Mines and Technology. The Station's headquarters is in Fort Collins, in cooperation with Colorado State University. Research reported here was conducted at the station's research work unit located at and in cooperation with the Amax Coal Company, Gillette, Wyo.*

[2] *Spot systems drip irrigation manual, Jon M. Congdon, FE spot systems a Division of Wisdom Industries, Inc., Kirkland, Wash.*

Line tension on the feeder lines is maintained by hand-made springs, constructed from a 12-gage wire cut to 18-inch lengths and twisted around a 1-inch diameter, wooden dowel. Three inches of untwisted wire should remain on each end (fig. 2). Other types of springs with moderate tension can be commercially obtained from most hardware stores.

One end of the spring is attached to the end plug on the feeder line, the other end is attached to a wooden or steel stake approximately 1 inch above ground level. Slight tension is put on the line.

Figure 2.—Spring attached to end of feeder line to maintain low tension.

Feeder lines are positioned 12 to 18 inches from the plant bases, allowing proper emitter distance (fig. 3). Periodically, it may be necessary to recompress the springs to insure proper tension, unless commercial springs are used.

Self-clamping, lead, tire balance weights attached to the emitter ends help reduce clogging and keep the emitter ends close to the plants.

This drip irrigation system delivers water more efficiently, is adaptable to most standard drip systems using polyethylene tubing, and greatly reduces maintenance time.

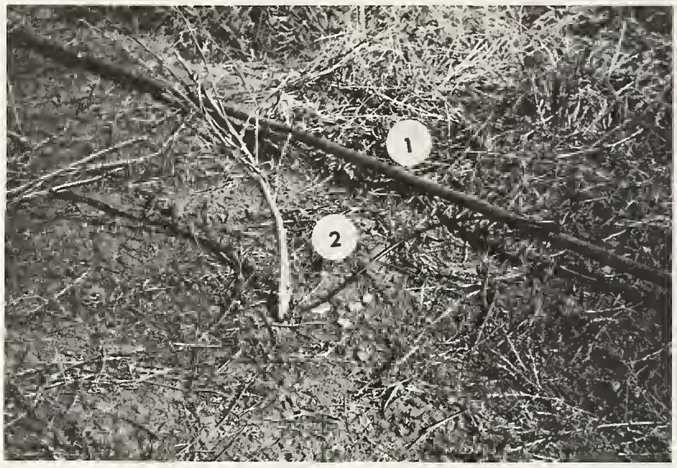

Figure 3.—Correct positioning for lateral feed line and emitter (1) feeder line, (2) distribution tube.

sions are based only on those fuels. However, Eakle and Wagle (1979) included woody fuels up to 2 inches in diameter in their forest floor samples. In the present study, the sampled forest floor was composed of needle and woody fuels up to 1 inch in diameter. Small woody fuels are an integral part of the forest floor. They should be included in the sampling, because they affect depth, loading, bulk density and, consequently, the way the forest floor burns. Furthermore, if woody fuels are included, 1 inch appears to be a favorable size class limit, because it coincides with that used in customary woody fuel inventories (Brown 1974) and with standard fuel moisture time-lag classes used in the National Fire-Danger Rating System (Deeming et al. 1977). A standard procedure designed to measure all important fuel components needs to be developed.

As stated, the use of a forest floor depth to loading regression on an inappropriate site can lead to inaccurate fuel loading estimations. In an oversimplified example, a fuels' manager must decide whether or not to prescribe burn an Arizona ponderosa pine site to reduce a fire hazard based on fuel loadings, average fire weather, and ignition potential. If an average forest floor depth of 2.5 inches was measured, the estimated weight per area using each of the four relationships shown in figure 2 would be approximately 16, 21, 24, and 36 tons per acre. Under certain fire weather and ignition potential conditions, 16 tons per acre of forest floor may not create a hazardous situation, whereas 24 or 36 tons per acre may. Therefore, selection of the wrong loading estimation equation could lead to an incorrect management decision.

Furthermore, problems can arise if a prescribed burn is planned with the incorrect presumption that an average of, for example, 16 tons per acre of forest floor fuels exists on a site, when actually 1-1/2 to 2 times that amount is present. Assuming that an equal percentage of the forest floor would burn regardless of loading, the site would be subjected to 1-1/2 to 2 times the amount of total heat per unit area from the burning of these unexpected fuel quantities than was expected. Under the burning prescription chosen for the assumed lighter loading, greater damage to trees, understory vegetation, and soil properties might result.

Another point illustrated by this study is that even with the use of a regression developed for a specific site, some uncertainty exists, as demonstrated by the range of the 95% confidence limits of the regression in figure 1. At any given depth, the amount of the forest floor loading could vary from the estimate by as much as 6 tons per acre.

In conclusion, Eakle and Wagle (1979) suggested that their depth to loading regression developed in eastern Arizona was directly applicable to the southwestern ponderosa pine forests, but potential users are cautioned about the widespread application of any forest floor relationship without some site-specific testing. Barrager et al. (1982) also recommended improving fuel knowledge where planned prescribed burning involves sensitive resources.

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